PUBLIC WORKS

CITY COUNTY STATE

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CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 52 FEBRUARY 11, 1921 No. 6

North Avenue Viaduct, Milwaukee

Structure 1,385 feet long, 61½ feet wide and 44 feet high, carrying roadway, trolley tracks and sidewalks on retained fill, reinforced concrete and plate girder viaducts and long concrete arch rib spans.

The old four-span steel-truss deck bridge, 40 feet wide, that carried North avenue, Milwaukee, across the Milwaukee river at a height of about 25 feet above water level, has just been replaced by a $710,000 structure, 1,385 feet long, which crosses the river with three two-rib, reinforced concrete arch spans of a total length of 571 feet 7 inches, with 814 feet of plate girder, concrete and retained fill approaches in the axis of the bridge and a 600-foot concrete side approach 28 feet wide at right angles to it. The main structure carries a 40-foot roadway with two trolley tracks and has two 10-foot 9-inch sidewalks and a new elevation that insures a uniform grade over nearly the entire bridge and increases the height of the roadway a maximum amount of about 22 feet 8 inches. The piers and abutments are of concrete, with foundations on solid clay and gravel strata from 12 to 20 feet below the original surface of the ground.

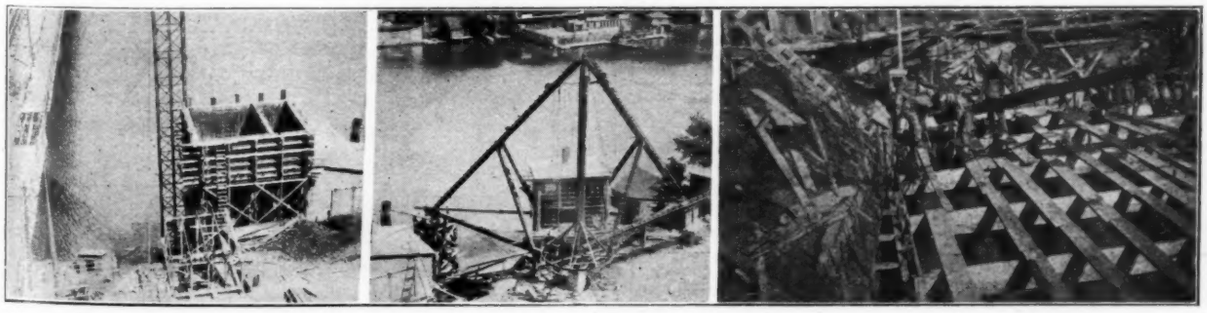
The bridge is a handsome, dignified structure designed to present an attractive appearance and in harmony with the surroundings, to provide abundantly for present and future traffic requirements, and to secure strength and durability with the minimum capitalization for construction and maintenance.

It is of interest on account of the harmonious treatment of the substructure and superstructure, the up-to-date character of construction, and the very successful combination of different types and details of construction to meet varying conditions and requirements for different parts of the structure and still preserve economic relations and secure symmetry of proportions and details.

The bridge was designed and its construction was directed by the Department of Public Works of the city of Milwaukee, of which Percy Braman is Commissioner of Public Works and David M. Keith was acting superintendent of bridges previous to Jan. 1, 1921, since when Manuel Cutler has been superintendent. J. C. Pinney, Jr., acted as consulting engineer. The general contract was awarded Feb. 10, 1920 to Klug & Smith, Milwaukee, and work was commenced July 12, 1920, to be finished within 400 working days after the beginning, under penalty of $500 liquidated damages for every day more than 400 before completion of the work.

The principal estimated quantities include 18,200 cubic yards of excavation, 17,000 yards of concrete, and 182 tons of structural steel. On December 1, 1921, all of the work was completed except paving on the approaches, light post installation, and other minor details and the bridge was open to all traffic on Dec. 15, 1921.

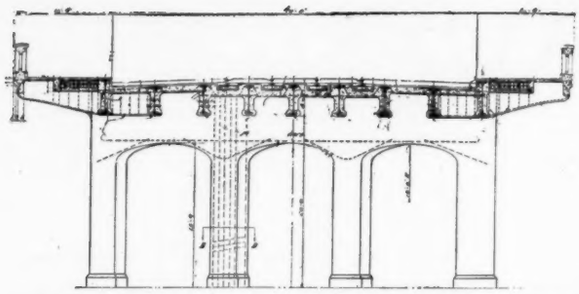
The bridge consists structurally of six sections, beginning at Humboldt avenue, with section No. 1 consisting of about 187 feet of embankment approach retained between concrete side walls of a maximum height of 13½ feet above the surface of the ground.



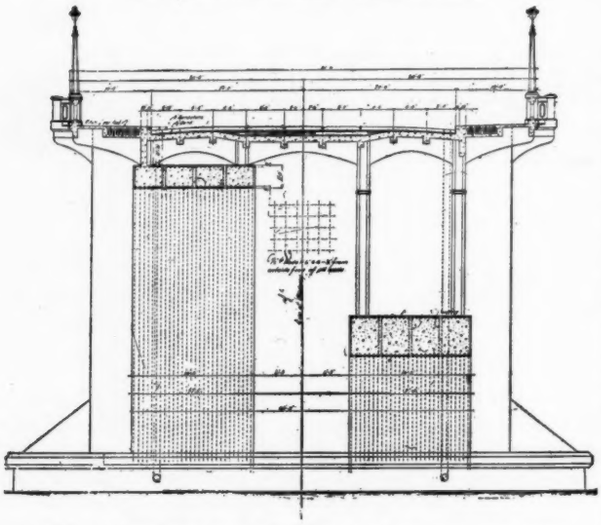
SAND AND STONE BIN OVER CONCRETE MIXER

YARD DERRICK UNLOADING AGGREGATE AND CEMENT

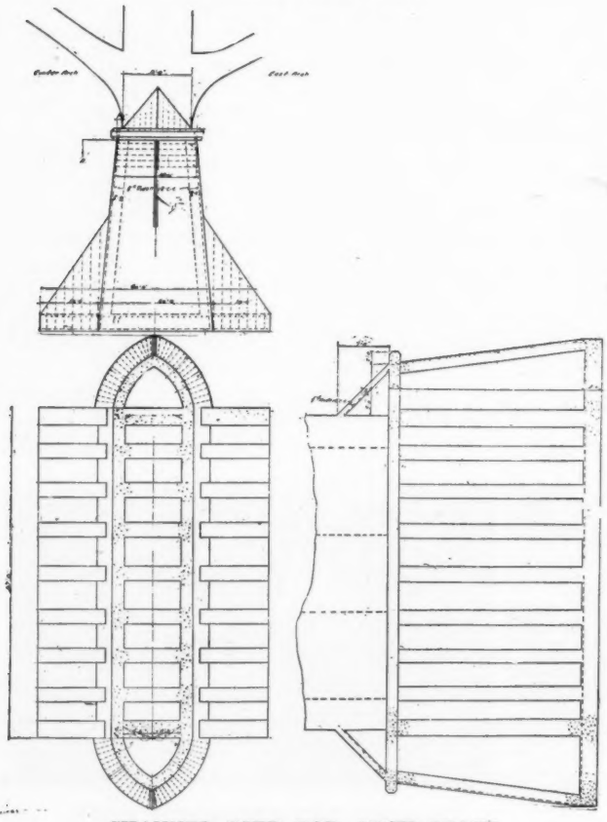
PLACING REINFORCEMENT IN PIER FORM



TRANSVERSE SECTION THROUGH SKEW SPAN OF PLATE GIRDER STRUCTURE



CROSS SECTIONS OF ARCH SPAN AT CROWN AND NEAR SKEW BACK

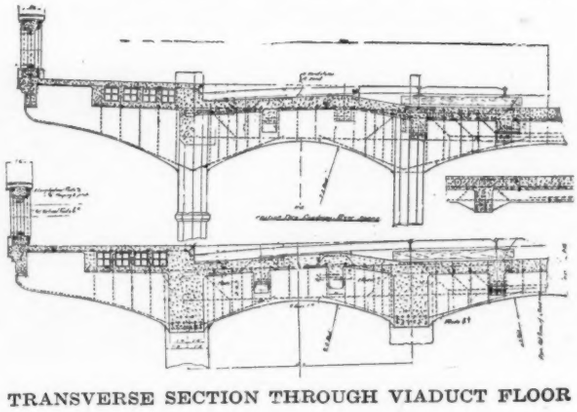


CHANNEL PIER FOR ARCH SPANS

Section 2, about 142 feet long, is of concrete beam and slab construction supported on concrete columns, 35-foot centers. Section 3 carries a roadway over the tracks of the Chicago, Milwaukee & St. Paul Railway and is about 140 feet long with three skewed plate girder spans incased in concrete. Section 4, about 316 feet long, is of concrete beam and slab construction, supported on concrete columns, 33 feet 8 inches centers. Section 5 is a side approach to the viaduct parallel to the axis of the river and is of concrete column, beam and slab construction, 26 feet wide and 600 feet long. Section 6 consists of three arches with clear spans of 155 feet 2 inches, 166 feet 3 inches, and 155 feet 2 inches. The viaduct floor is carried on transverse bents of four columns each and the piers and abutments for the river spans are of hollow reinforced concrete construction.

The first section of the bridge begins at the east line of Humboldt avenue and consists of a retaining wall with earth fill extending about 187 feet east, with a height above the surface of the ground increasing from nothing to about 13½ feet. The fill is retained on one side and one end by reinforced concrete walls 12 inches thick at the top and 16 inches in maximum thickness at the bottom, which are seated on continuous reinforced concrete footings 2 feet thick and having a maximum width of 10 feet. The walls are 18 inches clear of the outer face of the footings, to which each of them is braced by five reinforced buttresses 12 inches thick, on the inner face of the wall, which are imbedded in the fill that covers the upper part of the footing and serves as a counterweight to resist overturning by the horizontal thrust of the embankment. The surface of the fill is entirely covered by a continuous concrete slab 9 inches thick under the roadway and 4 1/2 inches thick for the sidewalks. Under the roadway the concrete slab is depressed to form pockets for receiving street railway ties and rails, concreted between, and the remainder of the roadway area is covered with a sand-cement cushion and paved with sandstone blocks.

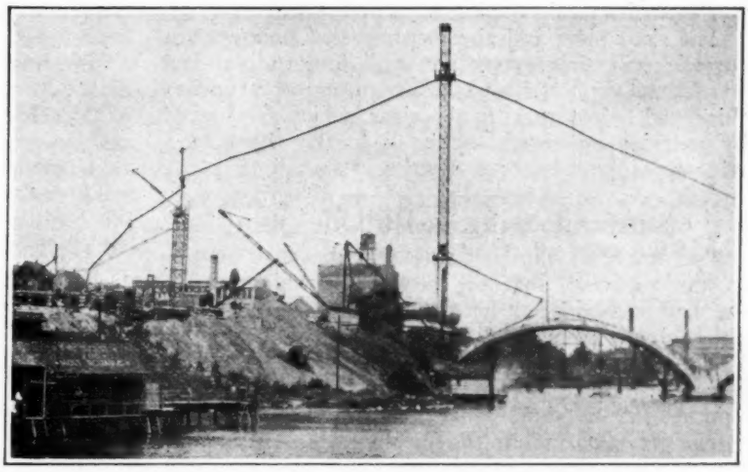
The viaduct proper consists of short spans with reinforced concrete floor slabs supported on vertical columns which are arranged in four-column transverse bents, except in the side approach, where the bents have only three columns. Over the tracks of the Chicago, Milwaukee & St. Paul Railway Company the floor is carried on three spans of plate girders incased in concrete, protecting them from the locomotive gases below. The girders have spans of



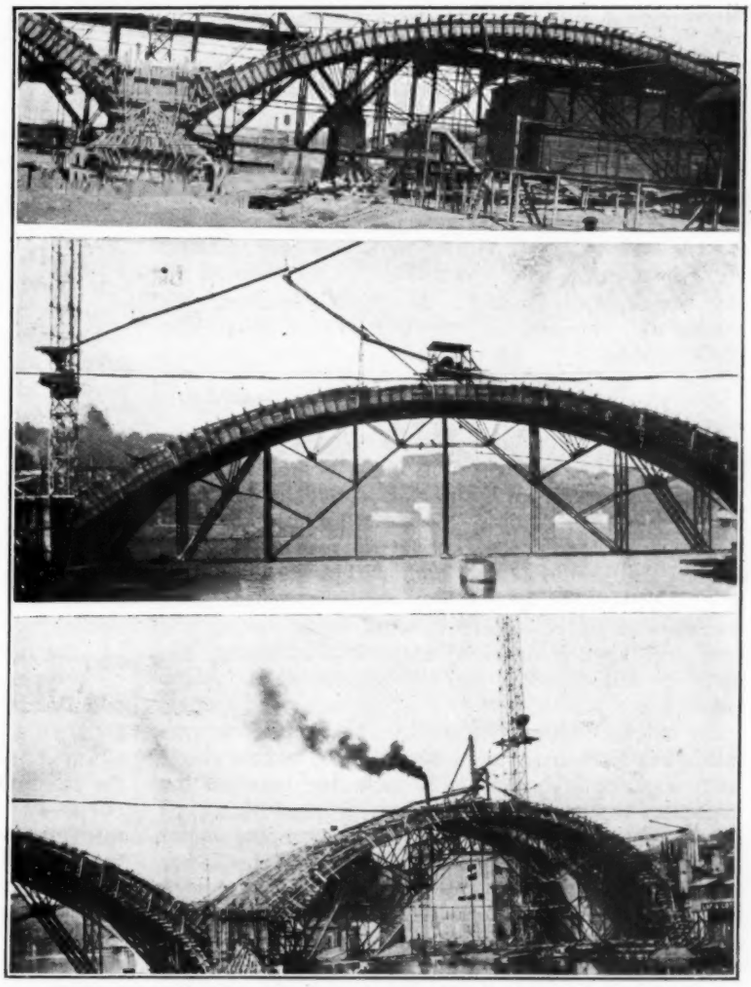
TRANSVERSE SECTION THROUGH VIADUCT FLOOR

44 1/2 feet and those supporting the street car tracks are spaced 5 feet apart, and are 34 inches deep. The curb girders are 40 inches deep and carry the structural steel sidewalk brackets supporting the sidewalks and are incased in concrete. These brackets are virtually extended across the curb girders to the next line of roadway girders, a distance of 5 feet 4½ inches, by structural steel diaphragms incased in concrete and are in the planes of the brackets, engaging the two lines of girders and tending to distribute the cantilever reactions. The plate girders are seated on the reinforced concrete girders, connecting the tops of the viaduct columns and at the ends are provided with expansion bearings. The transverse column bents are parallel to the railroad tracks and make an angle of approximately 45 degrees with the axis of the bridge, thus giving the spans a sharp skew that is taken up by triangular panels of floor construction with each of the panels of the regular viaducts and at both ends. In the remainder of the regular viaduct the spans are 33 feet and 35 feet long on centers, and the roadway slab, 9 inches thick, is carried on stringers and floor beams to reinforced concrete longitudinal girders, supported directly by columns, and on the immediate longitudinal stringers cast integral with the slab, parallel to the main girders and supported on transverse concrete floor beams, connecting the longitudinal girders. Expansion joints in the floor are made with pockets filled with asphalt, and the bearings of the girders and floor slabs are made with tar paper to prevent adhesion between the fixed and moving surfaces.

The arch spans cross the river and are substantially alike except for variations in length. The 164-foot 3-inch center span has a rise of 36 feet, and, like the other arch spans, has two main ribs 16 feet wide and 12½ feet apart in the clear, with three-center curves for the intrados and extrados. The two main radii of the intrados are about 134 feet and 113 feet long. The ribs have crown depths of 3 feet for the center and east span and 2 feet 10 inches for the west span, and those of the center span are reinforced longitudinally near the top and bottom of it with forty-eight 1½-inch diameter bars, assembled with rectangular ½-inch hooping in four sets of 12 bars each. Transversely, near the top of the ribs at the column bases, there are eleven ⅞-inch diameter rods, and throughout the remainder of the ribs there are ⅞-inch diameter rods, 3 feet on centers, alternately top and bottom. The floor slabs are supported on spandrel walls at the crowns of the arches and on two longitudinal rows of the spandrel columns at each



CONTRACTOR'S PLANT, AGGREGATE STORAGE, 220-FOOT STEEL HOISTING TOWER AND SPOUTING SYSTEM



COFFERDAM AND FORMS FOR CHANNEL PIERS BEFORE WATER LEVEL IN RIVER WAS RAISED
CONCRETING RIB FORMS SUPPORTED ON STEEL ARCH CENTER TRUSSES IN MAIN SPAN
220-FOOT HOISTING TOWER AND LOW LEVEL HOPPER AND CHUTES FOR SPOUTING CONCRETE TO FIRST SPAN

side of each rib. The tops of the exterior columns are connected by reinforced fascia girders with curved lower edges giving them an arched appearance. The octagonal columns, 20 inches in diameter, are each reinforced with eight ¾-inch vertical rods and ⅜-inch spiral hooping of 3-inch pitch.

The river piers and abutments are of hollow reinforced concrete construction with longitudinal and transverse vertical walls and diaphragms 30 inches thick and 5 feet apart in the clear, which are braced by exterior buttresses extended to the edges of a wide reinforced concrete footing 3 feet thick.

Snow Clearing in Philadelphia

The storm of January 28th was the most severe, it was reported, that the city of Washington, D. C., had experienced in more than 60 years, and although the intensity diminished towards the north, Philadelphia received a very considerable fall. This gave the municipal forces under Director Caven an opportunity to show what they could do with removal of snow from the city streets. It will be remembered that with the first of this year the municipal forces took charge for the first time of the city's street cleaning. Local papers state that, with all allowance for the fact that Saturday afternoon and Sunday, with their comparative freedom from traffic, were very favorable to the removal of snow, the municipal forces showed a promptness and thoroughness in beginning and completing the job that was conspicuously favorable when compared with work done in previous years by contract. Credit is given to Director Caven for having prepared beforehand an adequate plan of campaign for the snow removal. The first fight was concentrated on the business center and the street crossings all over the city and, as stated, this work was done with a thoroughness and celerity that was unusual for Philadelphia.

Elmira's Water Board Report

The second annual report to reach this office (notice of the first was published in our issue of January 7th) is that of H. M. Beardsley, general manager of the Elmira, N. Y., water board. Mr. Beardsley's report was submitted to the common council on January 16th and a copy reached this office a few days later. This report not only gives the amount of construction work done during the year but also a financial statement including the earnings and expenses and the balance sheet for the year.

As in other cities, the amount of work done was much less than in ordinary times. The largest single item was the laying of a 20-inch line between the main city reservoir and Elmira Heights, with a view to eliminating the excessive cost of pumping water to those heights; which was so successful that it has saved $1,816 in power costs during the five months it was in service. Only 146 services were added and 153 meters.

One interesting item in connection with the department's finances is that in May it purchased $25,000 of its own 4½% bonds at a price which returned it 5½% on the investment, while the bank was paying only 3½%. These bonds have not been retired but are held for re-sale as soon as the board is in position to make some extensive additions to the plant which are thought will be necessary in the near future.

The financial statement shows gross earnings of $202,626 and operating expenses and maintenance of $68,418. In addition there was interest on bonds and on consumers' deposits of $61,891 and deductions made for amortization and taxes of $11,192, while there were non-operating revenues of $4,586. This left surplus earnings of the year of $65,711, of which $35,000 must be used April first of this year in retiring outstanding bonds of that amount.

The balance sheet shows a value of plant and equipment of $1,656,954, while materials, supplies, current assets and other items bring the total assets up to $1,791,140. The outstanding bonds totaled $1,355, while the current liabilities, unamortized premium on debt and reserve for depreciation and compensation insurance add $87,321, leaving a surplus of $348,819.

Systematic Survey of Gravel for Road Purposes

By Wallace F. Purrington, Chemist and Testing Engineer, New Hampshire Highway Department

Excerpts from paper before Convention of American Road Builders' Association —Description of methods employed by New Hampshire Highway Department.

One of the first steps taken at the beginning of our survey was to make a map showing by colors the various areas occupied by different types of rock. This and the direction of glaciation had been worked out by the State Geological Survey under Hitchcock years before. Our success in future lines of investigation was to a great extent dependent upon this very detailed knowledge of the bed-rock and glaciation which was available at the start. * * *

Some of the most valuable information found by the survey of New Hampshire gravels was obtained by making counts of the stone composing each gravel. i.e., the percentage of granite, slate, schist or other rock type. For this purpose, at least 100 pebbles, taken at random, were counted and the results noted. By such a quick and simple measurement of composition it is quite possible to draw conclusions as to the strength of the gravel and so of its value for road purposes. Ordinarily there is not, in any given town, a great difference in the quality of gravel to be found. There are indeed, differences in the proportion of sand, pebbles and cobbles. This is true of the material found even at different points in the same bank. If, when gravel deposits were formed, the force of water with its load of material had been uniform, we might have had homogeneous deposits.

Such was not the case where eskers and kames and other glacial gravel deposits were built, consequently, one hardly knows what is to be found in any part of a deposit that is not visible. To the writer's mind any sample submitted to a laboratory for grading from gravel deposits like these is a mere waste of time. There may be some merit in testing a river of wash plain gravel in this matter, for these are more uniform. Other investigators have reached the same conclusions regarding the absurdity of laboratory grading of samples from glacial gravels. An intelligent manipulation of any pit will give better and more reliable results than any arbitrary grading system that may be devised.

Knowing from field studies, the nature of the deposit, the composition of the gravel as revealed by the stone count, the amount of gravel available and its *probable* grading, the testing laboratory has to pass final judgment upon its value to support traffic. The work carried on by our survey covered nearly 500 samples of gravel, taken at points which represent all the leading geological conditions. A comparison of the laboratory results was made with the count of the stones in every case.

The test used was the Rea modification of the standard Devel Abrasion Test, which modification consists in the addition of six steel balls, used as an abrasive. For the bed-rock, the standard Devel Test was carried on. The actual figures obtained were of course different but the relation between the two tests were similar. In other words, if we found that a certain bed-rock showed a high percent of wear when tested by the Standard Method, we would expect a similar high per cent of wear using the Modified Test on gravels composed chiefly of that type of rock.

As a result of the investigation, the State Highway Department has adopted the following as a specification:

"General.—Gravel shall be composed of fragments of hard, durable rock, the individual particles showing reasonable uniform resistance of abrasion, together with sand or clay or other binding materials.

Physical Properties.—The gravel shall meet the following requirements:*

Class A Gravel-Per cent of wear not more than	7
Class B Gravel-Per cent of wear	7-10
Class C Gravel-per cent of wear	10-15
Class D Gravel-Per cent of wear over	15

Class A and B gravels may be used for either or both base and surface courses; Class C may be used for base course only; and Class D may be used on special written permission of the Commissioner.

This specification is applicable to our conditions. It has been devised after noting the actual road making values of various gravels. It is purely arbitrary, but are limits which we can meet in New Hampshire, but it is appreciated that these values may not be feasible elsewhere.

There can be no question of the valuable to any highway department of a detailed survey of road materials. If the material in any deposit proves to be inferior, it stands to reason that there is a cause for the inferiority. The thorough knowledge of these causes, whether they are conditions of bed-rock or glacial geology should be obtained. For this the employment of a competent geologist is absolutely necessary. No well organized testing laboratory should be without one.

The testing laboratory should become a clearing house of information to which the engineer may refer, as often as new construction projects call for the selection of material anywhere in the state. Turning to the colored geological map the engineer sees at once whether the conditions of bed-rock and glaciation are such as to favor the occurence of strong or weak gravels. Colored pins on the map tell him the locations and general quality (in terms of strength) of all samples already collected and studied from that district. A number on each pin indicates the laboratory test number of that sample. Reference in the files to the cards bearing these numbers affords the more exact record of the stone counts and the abrasion tests. These facts enable the engineer to turn in the right direction in his search for gravel, avoiding loss of time through search where gravels are weak and looking rather for banks where stronger gravels must be expected. If his own knowledge of occurrence of gravel deposits there is incomplete he may call in the geologist for consultation or for a special field reconnaissance. In this way the best sources will not be overlooked. Samples are then collected from the more promising banks. Finally, the tests run on these samples by the laboratory will mainly determine the choice. Questions of amount available, relative economy of operating different banks, etc., will be left to the highway engineer and the administration officer. In short, the process of discovery and selection of gravel is scientific instead of haphazard.

*Tests to be made in accordance with the method described in U. S. Department of Agriculture Bulletin 555, page 301.

Diminished Labor Supply

A report just issued by the Department of Commerce, Bureau of Census, Washington, gives in detail the number of men employed for pay in the State of New York as 3,020,158 in 1910 and as 3,367,907 in 1920, showing a too small increase of only about 10%, while in some of the very important classes there has been a very serious decrease. Brick and stone masons decreased during this period from 28,300 to 19,676; farm laborers from 144,535 to 87,085 and building laborers and unclassified laborers from 88,559 to 50,521, thus accounting for the serious shortage that will become much more important as the drastic restrictions of immigration take effect.

Common and farm labor and masons are among the most numerous of immigrants and have always been relied upon for the necessary supply. The present deficiency, besides directly increasing wages, very much hampers the operations and reduces the efficiency of mechanics, retards all kinds of construction operations and is both directly and indirectly a serious factor in maintaining the high prices that discourage construction and are the principal reasons for the alleged unemployment.

Progress of the Pittsburg Road Tests

By Charles W. Geiger

Some sections of the road are giving way at spots, and these are being made passable by concrete blocks and planks so that the test can continue until all are broken up. No appreciable abrasion of surface.

According to engineers who are in charge of the test highway at Pittsburg, the concrete track is holding up in an exceptional fashion under the strain to which it has been subjected during the past weeks. Some sections of the highway, however, are beginning to show signs of breaking down, but this is not to be wondered at. While there are actually only about forty trucks in the service of the experiment makers, these are being run so constantly during the eight working hours of the day that it is figured that approximately 1,500 heavily loaded trucks a day pass over any given point on the oval highway. As there are about 30,000 motor truck in service in the entire state, it can readily be seen what heavy traffic is being concentrated on the highway to find out what type of concrete road construction will best stand the unusual strain of heavy haulage. It is further made clear that there is no indictment of the truck intended in the Pittsburg experiment, for the present laws regulating motor trucks are deemed ample to protect the highways from abuse.

On December 21 the side ditches of the highway were flooded and samples of the subgrade were taken on December 30. It is evident that the original subgrade was so compact that it is practically impervious to water, and it is not thought that it will become saturated except through the medium of suction under the slab pavement.

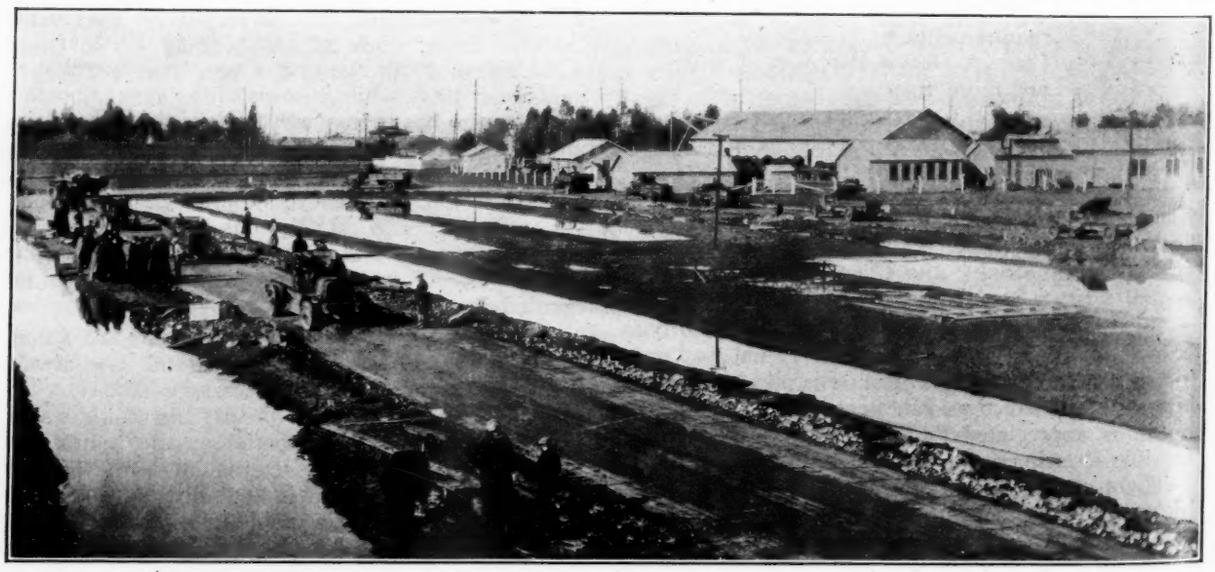
Lloyd B. Aldrich, engineer in charge of the tests, and his assistants are taking careful note of the conditions of the thirteen sections comprising the oval, noting how each type has withstood the traffic, but they will not be able to make a thorough or complete report until the series of experiments has been entirely completed.

During January more than 200 delegates representing the boards of supervisors of many of the California counties, county engineers, and members of the San Francisco Automobile Dealers' Association gathered at the Pittsburg track to observe the manner in which the highway is standing up. It was planned to give all the visitors a most intimate understanding of the construction and tests that are being made, and in order to do this motion pictures were shown, revealing in detail the process employed from the mixing of the concrete to the completion of the road. These moving pictures also showed the system devised for recording road shocks, impacts and other features. Moving pictures have been taken and will continue to be taken of the tests until the experiments are completed. The moving picture operator succeeded in photographing a section which happened to break under the impact of the truck wheels while the picture was being taken, which is considered very fortunate.

Moving pictures were taken of the Ames dials as the trucks were run over the impact planks placed across the track over the tunnel, and the action of the hand on the dial was shown very clearly.

Up to and including January 2, trucks running over the highway had aggregated 75,866 travel miles, while a total weight of 2,691,490 tons had passed over each slab which forms part of the roadbed.

As the weaker sections break up, the breaks are repaired, as shown in some of the accompanying



TEST HIGHWAY FLOODED—THE TRUCK NEAREST THE FOREGROUND IS JUST PASSING A BREAK IN SECTION H.

photos. The broken concrete is removed and an excavation made to a depth of 16 inches below the surface of the concrete pavement. Timbers 4 inches square are placed on the bottom of the excavation and on these are placed timbers 12 inches square, thus bringing the top of the timbers on a level with the surface of the concrete pavement. In one break, concrete blocks about 6 inches thick were used in making repairs. This proved very satisfactory and is shown in one of the photographs.

The evidence of traffic wearing away the concrete surface has been lacking. In fact, in the straight sections of the road no appreciable evidence of wear can be seen.

SCOPE OF TESTS*

The following tests were planned and have been developed up to date:

1. Static load, moving load and impact deflections in the slabs overlying the four observation tunnels. These are taken for a single loaded truck at various positions of the slab.
2. Impact deflection on one tunnel under a loaded touring car with various heights of drop and varying speed.
3. Same tests as noted in No. 1 except that two loaded trucks were used.
4. Temperature movement of slab.
   a. By observation (Ames dials) within the tunnels.
   b. By Ames dial readings from the slabs to iron rods driven 3 feet into the subgrade.
5. Temperature variations in the top and bottom of slabs in comparison with atmospheric temperatures.
6. Same tests as noted in No. 1, taking in addition the subgrade deflection as measured by Ames dials, reading from rods extending from plates just underneath the slab to the tunnels.
7. Extensometer measurements of strain in the pavement slab due to a loaded truck. These measurements taken simultaneously with vertical deflection readings in the tunnels with the purpose of obtaining a check on any analysis of stress in pavements which may be devised from these tests. Strain measurements and vertical deflection also taken at corners.
8. Laboratory tests of subgrade:
   a. Chemical analysis.
   b. Physical analysis.
   c. Moisture determination at various times and places.
9. Tests on materials entering into pavement:
   a. Aggregate tests.
   b. Cement tests.
   c. Tests on steel.
10. Tests on concrete:
   a. Compression tests of 5" and 12" cylinders.
   b. Tests for modulus of rupture.
   c. Tests of reinforced beams to show difference between beams reinforced with high tensile and structural steel.
11. Scale measurements of the opening of pavement cracks.
12. Traffic test subjecting all sections to regulated truck traffic. This test is proceeding with variations in loads and subgrade moisture content until complete failure of all sections, if this is feasible.

STATIC LOAD, MOVING LOAD AND IMPACT DEFLECTION TESTS

For making these tests, there are used the tunnels and contained apparatus described in the issue of PUBLIC WORKS for October 29, 1921.

By means of this equipment, deflection readings were taken as follows: The truck was started with its right hand wheels over the outside rods. As soon as the effect of the load was noted on the dials, the truck was stopped and readings taken on all rods. Then the truck was moved ahead two or three feet and similar readings taken. These were plotted in the form of an influence line for each rod. The moving and impact readings were obtained by reading the maximum deflection as the load went over. This maximum was accurately determined by means of a friction sleeve sliding on the rod fastened to the dial.

These tests were run before any real traffic was put on the highway and have been followed up at intervals since the traffic commenced, to see what effect the traffic might have on these results. The following notes in respect to these tests may be of interest:

1. On all slabs tested the effect of the load was felt from the time the front wheels reached a point 10 to 14 feet from the tunnel.
2. The first deflection noted almost invariably

*For the following information the author is indebted to Mr. Farmer, one of the Government engineers stationed at the test highway.

MEASURING VERTICAL MOVEMENT OF EDGE OF CONCRETE SLAB

REPAIRING BREAK BETWEEN SECTIONS L AND M. CONCRETE HAS BEEN REMOVED. STEEL REINFORCING IS SHOWN TURNED INTO VERTICAL POSITION

was a negative reading. The amount of this was from .0001 to .0008 inch but was readily discernible.

3. After the effect of the passing load was complete there was usually left a residual reading on the dials. This would be gradually reduced until in from one to two hours it would be almost entirely lost. If the test were run immediately after the cessation of traffic this set was practically negligible.

4. Up to the time traffic was started, the moving load deflection was slightly less than static load deflection.

5. Relative temperature of top and bottom of the slab alter very appreciably the deflection under identical loading conditions.

6. Movement of the subgrade as measured by the soil rods just described indicates that the subgrade movement is very much less than the slab deflection. It varies from approximately 20 per cent. of the slab movement at the edges to 50 per cent near the center of the slab. Subgrade deflection begins with the first indication of slab deflection and ends likewise. No satisfactory explanation yet offered.

7. Deflections of slab were run under two trucks, both going in same direction and with the trucks passing. No appreciable difference in the deflection readings could be detected.

8. In order to settle the question as to whether the deflection readings relative to the brackets in the tunnels were absolute, holes were bored in the bottom of the tunnels and pipes driven three feet into the subgrade. Inside these, rods were driven into the subgrade and deflection readings taken relative to these. Results showed a discrepancy of from 5 to 10 per cent. Probably a greater discrepancy at greater depths.

TEMPERATURE MOVEMENT OF SLAB

These movements have been studied by means of the two methods outlined. In the first method, the dials were all set at zero on the brackets and read during a period of 24 hours. Readings were taken at 2-hour intervals together with atmospheric temperatures and slab temperatures.

In the second method, holes were drilled in the header boards and at construction ⅜-inch rods 3 feet long were driven into the subgrade. The tops were approximately ½ in. below the surface of the slab. An Ames dial was affixed to a rigid base having three legs in such a manner that the propeller rod would just touch these driven rods when the above mentioned base was resting on the slab as shown in the accompanying photograph. A definite mark was made so that the base could always be placed at the same point on the slab. By this means the slab movements were studied at various sections around the highway. Readings were taken, at regular times. The same movement as noted in the first method was observed. The diagram shows the movement of the slab, and also shows how transverse cracks appear at the top of the waves in the pavement.

A third method was tried of using a lattice girder similar to the method used on the Bates road. This girder spanned the road and was supported on 4″x6″ posts planted in the shoulders. The girder was composed of 2½x2½x¼ angles spaced 18 inches.

The effect of varying temperature on this girder was found to have a large effect on the readings, such as to nullify the value of the experiment. It was suggested that, by using two identical girders and taking Ames dial readings from one to the slab and from the other to rods driven into the earth, very close net readings could be obtained. Both girders should be pointed in the same direction. This has not as yet been tried.

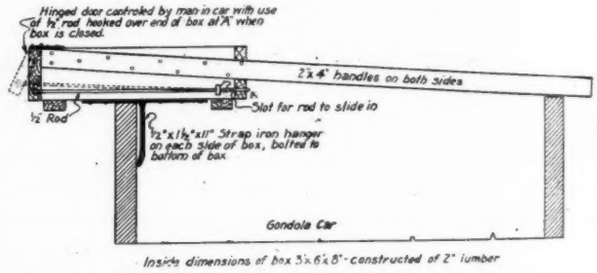
(To be continued)

Car Unloading Device

The accompanying engraving illustrates the hopper used for unloading cars of broken stone mentioned in the article on the Bankhead Highway, published on page 47, January 21st.

The hoppers of 12 cubic feet capacity were of simple construction and semi-automatic in operation. They involved no special materials or fittings, can be quickly and cheaply built by any contractor, and reduce time, cost and diffculty of unloading gondolas or other open-ton box cars, containing loose materials like stone, gravel or coal that have to be shoveled over the side by hand. The hoppers are so inexpensive that one can be provided for every car on the siding, enabling them to be simultaneously unloaded and obviating the necessity of delay or shifting.

The hopper consists substantially of a rectangular wooden skip which, in service, is balanced on the edge of the car side with the outer end overhanging the truck, wagon or batch box into which the material is to be dumped.



TILTING BOX FOR UNLOADING CAR BY HAND

The hopper is retained in position on the narrow edge of the car by a pair of bent steel lugs bolted to the bottom and engaging the inside of the car by a vertical projecting rib that prevents sliding outward and holds the skip in position as it revolves into the inclined dumping position.

The skip is supported just outside the center of gravity, causing a tendency for it to revolve downward into the car, which tendency is overcome by a pair of long horizontal handles bolted to the sides of the skip and resting at their extremities on the opposite side of the car.

This gives the skip stability while loading, after which the outer side is unlocked by releasing the latch rod A, and it is dumped by hand by lifting the extremities of the handles and thus easily overcoming its slightly overbalanced counter weight. The dumping requires only a few seconds, the skip returns to loading position by gravity without requiring adjustment, and the unloading will go on continuously with much less effort than is required for shoveling the material over the side and into the truck.

PUBLIC WORKS

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CONTENTS

Neglect of Water Purification Plants

The conditions found in water filtration plants in Iowa, as told by Mr. Hinman in a paper abstracted in last week's issue, are by no means confined to that state but may be found probably in every state where small water purification plants exist. Large purification plants are generally in charge of trained and responsible operators and their importance because of the large numbers of citizens depending upon them would tend to secure a closer supervision by the state health department. But the smaller plants are often in charge of men without technical knowledge or skill and insufficiently impressed with the importance of the continuous effective operation of the plant.

Investigations made by state health boards or others following typhoid epidemics have revealed on several occasions that those in charge of the water works had served raw polluted water to the citizens during a temporary break-down of the plant or other interruptions of its operation, sometimes without any notification whatever to the citizens with instructions that the water be boiled during the emergency. An instance has recently come to the writer's attention of a small plant for filtering and disinfecting a supply subject to pollution, the operation of which plant was entirely discontinued during the cold weather because, in the absence of any method of heating the building, there was danger that the chemical equipment would freeze.

In states where there are scores of small plants, it is impracticable for the state health officials to keep constant watch of all of them. It would seem, however, as though the officials or private companies having charge of such plants would feel a moral responsibility that would restrain them from any such negligence or deliberate failure to protect the consumers. The failure of a plant temporarily to produce satisfactory results may be due sometimes to unknown or unforseeable conditions and in some cases may be excusable; but the deliberate omission of acts known to be essential to securing the safety of the supply should be made a crime and subject the responsible officials to severe punishment.

We believe that most sanitarians will agree that there is more danger in the occasional omission of precautions which have become a regular feature of a supply than there would be in the continuous furnishing of such a supply without treatment, in that the regular consumption of a polluted supply brings with it a certain immunity to the regular consumers thereof, which immunity is gradually lost by the consumers after months or years of habitual use of a practically sterilized water.

Whether this idea of immunity is admitted or not, the fact remains that present knowledge of the causes of disease renders it unthinkable that a civilized community should countenance the deliberate serving of polluted water to the consumers of any water supply. Much can possibly be done to prevent this by educating the small communities to an appreciation of the importance of the uninterrupted operation of plants installed for purifying the supplies on which they depend, and it would seem desirable for state health boards to secure the co-operation of the newspapers of their states, and especially those of the smaller communities, in keeping this idea before the citizens of such communities. In addition, as stated above, it seems to us that deliberate failure to operate such purification plants should be made punishable by state law.

Paving Assessments

The monthly publication of the National Municipal League for February is devoted to a discussion of "Special Assessments" to "meet the demand for information on special assessment administration." It discusses the distribution of costs and methods of assessing improvements of various kinds, chiefly improvements of street surface, sewers, parks and public utilities. Most states and cities recognize the principle of assessing for improvements of one kind or another, but the method of assessing and the distribution of the cost is by no means uniform in all states, nor by all of the cities in most of the states, although some have adopted state laws requiring prescribed methods.

It has been our practice for several years to collect, during the first month of the year, data concerning street paving, and this year we included in our questionnaire questions concerning the methods of assessing for paving employed in the different cities. These and other statistics connected with paving will be published in the issue of February 18th and a number of succeeding issues (since the amount of material collected is too great to be included in a single issue), and those municipal officials, either engineers or members of commissions or councils, who are interested in the financing of street improvements will find in the articles based

upon these data valuable information from 700 or 800 cities and towns in all states of the country, sufficient to give a very complete idea of the relative popularity of the various methods employed.

Sewage Treatment in Imhoff Tanks*

By Russell Riker

Foaming in tanks and experiences in trying to control it—Seeding or inoculation, breaking up scum and others—Chemical analyses of sewage and sludge.

FOAMING AND ITS CONTROL

Not only in this state have operators experienced such trouble with foaming, but it seems to be universal throughout the country. The experience at Baltimore has already been commented upon by Thomas D. Pitts, in which he states: "I do not believe that the Imhoff tanks will prove satisfactory for any plant which has to handle quantities of sewage approximating ours." He further states that his belief is due chiefly to the increased cost for maintenance and operation which has been experienced at the Back River plant. The layer of scum which formed on the surface of the tanks was so deep that it frequently extended below the surface of the baffles and the tank had to be put out of service until the scum sank or was skimmed off.

A great many engineers, including Dr. Imhoff, later condemned the downward and upward flow tank, so that this feature was eliminated from two of the Baltimore units and these placed in operation in May, 1919, and in the fall of 1920 two other units had been changed in the same manner and placed in operation. In December, those tanks which had been altered and operated during the previous summer began to foam and investigation showed that scum had filled the gas vents completely from the surface to the level of the slot.

At the Albany plant in the summer of 1920 there was very little trouble due to foaming. Several of the gas vents overflowed, but upon changing the direction of flow the foam in the gas vents ceased. Early in the spring of 1921 it was noticed that considerable belching was taking place in the flowing through compartment, although the operator was quite certain that the sludge in the bottom did not reach the level of the slot. It is thought that gas laden sludge was coming up through the slot due to the fact that gas vents were already filled to capacity. It is also understood that the tanks at Columbus, Ohio, have recently passed through a period of foaming, which the operator has been unable to cope with.

A great many of the operators of the large plants state that foaming can be controlled by reversing the flow and drawing sludge. This practice has been tried in New Jersey with considerable success and the operators have been advised to draw sludge more frequently in small quantities. Care must be taken, however, not to follow the experience of the Oaklyn operator in drawing too much sludge.

In addition to the above, experience has shown that it is not advisable to use too much water in keeping the foam down. Only enough water should be used to loosen the scum and then it should be agitated by paddling. Shutting off the flow of raw sewage into the tank and allowing it to rest until satisfactory bacterial action has again started in the tanks is also an admirable method of operation, but this cannot always be accomplished where the capacity of the plant is small or where there is only one unit at the plant. Lime has been used by some operators with success, particularly when starting the tank, but in a few cases it has resulted in the production of a very offensive sludge. Where the sludge is already alkaline it may be of some benefit in reducing the formation of gases by chemical composition with them.

Foaming may be attacked from two different angles; one from a bacteriological standpoint—inoculation, and the other by a mechanical breaking up of the foam.

Seeding. Considerable work has been done on seeding tanks before placing them in operation. The most important experiments were carried on at Baltimore, where successive tanks were seeded with purified sewage, digested sludge, newspapers and lime. Scum formed in all the tanks and overflowed the gas vents, although it may be said in defense of one tank, seeded with newspapers and ripe sludge, that the foaming was not as intensive as in the others.

Seeding was tried out at Plainfield, N. J., in 1916, but without marked success. Our experience would indicate that it may have a beneficial effect but that foaming will and has occurred even when the tank has been well seeded with ripe sludge. It is probable that ordinary bacterial decomposition overcame enzyme action. The only object of inoculation would be to supply an abundance of enzymes after an alkaline reaction has been established.

Breaking up Scum. A means for mechanically breaking up the scum in the gas vents has been instituted at Austin, Tex. This control device consists of a 12-inch cast iron pipe centered in the gas outlet, with its top about 12 inches above the sewage line and its bottom at about the level of the slots in the settling chamber. Both the top and bottom of the pipe are open, but at the bottom a gas deflector is hung to prevent gases from ascending through the pipe. Water under pressure is sprayed into the top of the cast iron pipe, should foaming occur, to break up and carry down the scum and floating sludge. It seems quite practicable except in those cases where the entire depth from the top of the gas vent to the bottom of the sludge chamber is filled with viscous floating sludge.

Another method suggested by Leslie C. Frank, of the U. S. Public Health Service, to cut down scum formation or rather to produce better sludge, consists of circulating the bottom sludge. Where it is necessary to pump the sludge from the bottom of the tank in order to discharge on the sludge bed and where a circular tank is to be constructed, this system is very simple and can be constructed with little additional expense. It consists of a compressed air system for removing the sludge. Valves

*Concluded from page 91.

and piping are so arranged that the sludge outlet pipe can be shut off and the bottom sludge returned via the gas vents. It is well to introduce the sludge in a circumferential direction in the scum chamber so as to produce rotation. Projects may be inserted on the inside wall of the circular scum chamber so as to produce revolving eddies. This would be equivalent to having a number of sludge valves discharging on the scum surface. Such an apparatus is now in operation at Tenack, New Jersey.

It is thought that a very fine spray is very effective in breaking up the bubbles as they reach the surface, but care must be taken not to add too much water to the foam.

The construction of a screen in the gas vents to keep the scum water-logged has not proved successful. The addition of oil (kerosene) to the gas vents is not entirely successful, although good results can be obtained from it for a short period. Agitating the sludge with paddles is the most effective.

CHEMICAL ANALYSIS OF SEWAGE AND SLUDGE

Although many analyses have been made by the Department of Health of this state of the raw sewage, the settled sewage, and of the sludge and scum in Imhoff tanks, no helpful information has been gained from them with perhaps the exception of the analysis for fats.

sewage after leaving the tank the better it can be treated by secondary purification. It is better not to return to the old septic tank tank treatment of sewage, where very stale, offensive septic sewage is discharged from the tank, but it is believed that a number of one-story settling tanks operated in rotation will give equally as good results as the two-story tank with much less operating expense. In fact, such installations installed in New Jersey, where the tanks are turned off as soon as the effluent begins to become charged with suspended matter and the settled sludge allowed to digest for a certain period of time, results have been very satisfactory.

In closing this discussion, we would advise any municipality that intends to install a sewage treatment plant, to first consider carefully before deciding upon the use of Imhoff tanks for settling purposes. It is admitted that all methods of sewage treatment have their disadvantages and that no one method has proved satisfactory for all conditions, but it is thought that the time has arrived when the promiscuous installations of Imhoff tanks should cease. The art of sewage treatment has advanced rapidly during the last few years, so rapidly that sufficient study has not been made upon any one method to determine its advisability under different conditions.

ANALYSIS OF SLUDGE
FROM LARGER IMHOFF TANKS IN NEW JERSEY

			WET SLUDGE			DRY MATERIAL			
Plant	Appearance of Sludge	Alkalinity	% Water Contain.	% Dry Material	% Fats	% Mineral Matter	% Organic Matter	% Fats	Odor
Chatham-Madison	Dark Gray	Slightly Alkaline	94.21	5.79	0.956	44.57	55.43	16.51	Rubber
Hammonton	Dark Gray	Slightly Alkaline	88.79	11.21	1.540	52.46	47.54	13.74	Musty
Plainfield	Gray	Highly Acid	87.52	12.48	1.492	27.49	72.51	11.16	H_2S
Princeton	Black	Alkaline	93.92	6.08	0.416	37.89	62.11	6.91	Musty
Ven.nor	Black Grained	Highly Alkaline	91.94	8.06	0.752	41.19	58.81	9.33	Tar
Westfield	Black	Highly Alkaline			0.828				Rubber

NOTE: Plainfield sludge has turned alkaline since this analysis and its physical condition has improved.

It would seem that those plants that contain the smallest amount of fats in the sludge have better sludge digestion. We have found that in many cases plants that were foaming or contained an excessive amount of sludge in the gas vents contained a sludge which analyzed better than plants that were working in a normal condition. The alkalinity of the raw sewage is quite important in order to determine whether to add lime, and the water content of the sludge is also of importance, but complete analysis of the sludge and scum has revealed very little helpful information.

It is believed that the principle of separate sludge digestion is an excellent one and that the method of having a separate tank for the sludge digestion can be improved so that many of the inconvenient factors now entering into the operation can be smoothed out. One very valuable result has been obtained from the operation of the Imhoff tank; that is, knowledge that long periods of detention in the settling chamber are not necessary. The fresher the

Iowa Road Construction

During 1921 the work done by the Iowa State Highway Commission included 165 miles of paving, 368 miles of gravel and 1,051 miles of grading, a record that it is expected will be excelled in 1922, when there will probably be 1,500 miles of construction finished, embracing 100 miles of paving and 500 miles of gravel surfacing.

Hard surfacing for this primary road systems has already been authorized by 27 counties and 13 of them during 1919 authorized $18,475,000 bond issues.

AVERAGE COST OF HIGHWAY CONSTRUCTION IN IOWA IN 1921

Type of Road	Let in 1921 or held over from previous years	Construction in 1921	Average Cost per mile
Bituminous Filled Brick..	18.35	13.44	$58,100
One Course Concrete....	152.67	151.92	$40,700
Bituminous Penetration Macadam	8.57	6.04	$20,195
Gravel surfacing	501.79	361.65	$ 2,500
Earth Roads	1,464.15	1,050.88	$ 3,300

Recent Legal Decisions

CLOSING OF STREET FROM CURB TO CURB FOR PARKING PURPOSES NOT AN ABANDONMENT OF THE STREET

A property owner claiming the fee of a street from property line to property line claimed the erection by the municipality of a concrete bulkhead from curb to curb of the street to be a physical closing of the street amounting to an actual abandonment by the city. It was held Keller v. City of Oakland (Cal. App.) 201 Pac. 618, that, since only a part of the street was closed by the bulkhead, and it was apparent from an ordinance setting apart part of the street for parking purposes that the relinquishment of a portion of the street was not a permanent relinquishment, and was made upon the condition that it was to be revocable at will by the city, the municipality's act was not an abandonment of the street.

BUILDING ORDINANCE HELD VALID

An ordinance of a city in Nebraska required the submission of plans and specification and the obtaining of a building permit from the building inspector to be granted by him only after careful inspection of the plans and specifications, and his findings that the building will be of sufficient strength and with proper means of ingress and egress, the permit to be subject to revocation by the city council if the work is not done according to the application for permit. The Nebraska Supreme Court holds, James H. Daily estate v. City of Lincoln, 185 N. W. 332, that the ordinance is general and uniform in its provisions, and does not grant arbitrary powers to the building inspector and city council, and is not, for that reason unconstitutional. A building ordinance regulating the kind of buildings to be erected, and requiring the construction thereof according to the plans and specifications and with the spirit and letter of the ordinance, would be a nullity, unless power was given to determine whether the proposed building was in conformity therewith, and to require construction in conformity to the plans and specifications, and the power to cancel a permit if not so built. The city council might have reserved these rights to itself or might delegate the power, as in the instant case, to the building inspector * * * The courts are quite uniform in holding that building ordinances that do not prescribe a general or uniform rule for building, and vest the power to grant a permit in a building inspector, are unconstitutional in conferring arbitrary powers upon the person clothed with authority to grant a permit. Such an ordinance might subject the property owner to the arbitrary will of the inspector. The ordinance in question grants no such arbitrary power to the building inspector * * *"

CONTRACTOR HELD NOT ENTITLED TO CHARGE FOR EXTRAS WHERE TERMS OF CONTRACT THEREFOR NOT FOLLOWED

A municipal contract provided that: "No extra work will be paid for or allowed unless the same was done upon the written order of the engineer. . . All claims for extra work must be made to the engineer in writing before the payment of the next succeeding estimate after the work shall have been performed, and failing to do this the contractor shall be considered as having abandoned his claim." In an action by the contractor for extras, it was held, Nelson v. City of Eau Claire (Wis.), 186 N. W., 168, that a claim for extras was demurrable under the pleadings and the terms of the contract, where there was no allegation that the extras were furnished upon the written order of the engineer, or that claims were made in writing therefor before payment of the next succeeding estimate.

PREPARATION FOR BUILDING UNDER PERMITS DOES NOT PREVENT INCLUSION WITHIN FIRE LIMITS BY SUBSEQUENT ORDINANCE

The Arkansas Supreme Court holds, Wilder v. City of Little Rock, 234 S. W., 479, that the fact that the receiver of a permit to construct a wooden building outside the existing fire limits acquired the property and made preparations for constructing the building under the permit prior to the passing of a new ordinance extending the fire limits so as to include the site of the intended building, did not give the holder of the permit any vested rights authorizing him to restrain interference with the construction of the building.

EFFECT OF FAILURE IN REQUIRED PRESSURE ON RECOVERY OF RATES FOR FIRE PROTECTION SERVICE

The Borough of Ridgefield, N. J., is supplied with fire protection service by the Hackensack Water Company from three sources, the Weehawken high district, the Englewood high district, and the New Milford low district. In a suit by the water company to recover for the fire protection service at the rates prescribed by the Board of Public Utility Commissioners, the New Jersey Court of Errors and Appeals holds, Hackensack Water Co. v. Mayor, etc., of Borough of Ridgefield, 115 Atl. 399, that the fact that part of the Borough supplied from the New Milford low district was not furnished with water at the required pressure and quantity is a defense for the borough so far as regards the rates for that portion of the borough not properly supplied; the rates from each source being a matter of calculation for each portion of the service. It was not error for the trial court to direct a verdict for the water company for the rates in that portion of the borough where the service had been furnished.

CITY NOT LIABLE FOR INJURY TO CHILD BY NAIL IN PLANK PLACED IN STREET

A heavy plank was removed from a defective culvert and laid in the bottom of a ditch at the side of a street by property owners. A child playing in the street lifted one end of the plank and let it fall in such a manner that a nail in the plank pierced its foot. The Minnesota Supreme Court holds, Spiering v. City of Hutchinson, 185 U. W. 375, that the city was not chargeable with negligence in failing to foresee and guard against such an unlikely occurrence.

NEWS OF THE SOCIETIES

CALENDAR

Feb. 12-17—CONFERENCE OF HIGHWAY ENGINEERING, 8th annual conference. University of Michigan, Ann Arbor, Mich.

Feb. 13—ENGINEERS' CLUB OF BOSTON. Boston, Mass.

Feb. 13-16—AMERICAN CONCRETE INSTITUTE. Annual Convention Cleveland. Secretary Harvey Whipple, 814 New Telegraph Bldg., Detroit, Mich.

Feb. 14—NATIONAL HIGHWAY TRAFFIC ASSOCIATION. Automobile Club of America. New York City.

Feb. 14—SOCIETY OF INDUSTRIAL ENGINEERS. Auditorium Hotel, Chicago, Ill.

Feb. 14—THE NEW ENGLAND WATER WORKS ASSOCIATION. Boston City Club, F. J. Gifford, Sec., 715 Tremost Temple, Boston.

Feb. 14—ENGINEERING SOCIETY OF BUFFALO. Iroquois Hotel, Buffalo. Secretary—N. L. Nussbaumer, 80 W. Genessee St., Buffalo.

Feb. 15—NEW YORK SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS. New York City.

Feb. 15-17—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Tenth midwinter convention. Engineering Societies Bldg., New York City.

Feb. 15-18—NEW JERSEY STATE HIGHWAY COMMISSION. Second annual meeting. Trenton, N. J.

Feb. 17—NEW JERSEY SEWAGE WORKS ASSOCIATION. Annual meeting. State House, Trenton, N. J.

Feb. 20-23—NATIONAL ASSOCIATION OF BUILDERS' EXCHANGES. Annual meeting. Hotel Chisca, Memphis, Tenn.

Feb. 20-23—AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS. Engineering Societies Bldg., New York City. Secretary, F. F. Sharpless, 29 W. 39th st., New York City.

Feb. 21-22 — KENTUCKY ASSOCIATION OF HIGHWAY CONTRACTORS. Annual meeting. Louisville. Secretary, D. R. Lyman, 523 Court Place, Louisville, Ky.

Feb. 21-23—MINNESOTA FEDERATION OF ARCHITECTS AND THE MINNESOTA SOCIETY OF CIVIL ENGINEERS. First annual convention. Curtis Hotel, Minneapolis.

Feb. 22—AMERICAN ASSOCIATION OF ENGINEERS. Conference of practicing engineers. Congress Hotel, Chicago.

Feb. 22—AMERICAN BUILDING EXPOSITION. Municipal Auditorium, Cleveland, Ohio.

Feb. 24-25—ENGINEERING SOCIETY OF WISCONSIN. Annual meeting. Madison. Secretary—L. E. Smith, Madison.

Mar. 14-16—AMERICAN RAILWAY ENGINEERING ASSOCIATION. Annual convention. Chicago, Ill.

Mar. 15—NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Engineering Societies Bldg., New York City.

Mar. 18—ROCHESTER ENGINEERING SOCIETY. Quarter-centennial dinner.

Mar. 23-24—ILLINOIS SECTION, AMERICAN WATER WORKS ASSOCIATION. Fourteenth annual meeting. Urbana, Ill.

Apr. 19-21 — TRI-STATE WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA. Spartansburg, S. C.

Apr. 27-30—BUILDING OFFICIALS' CONFERENCE. Apr. 27-28, Cleveland, O.; Apr. 29, Masillon, O.; Apr. 30, Youngstown, O.

May 15-19 — AMERICAN WATER-WORKS ASSOCIATION. Annual convention. Philadelphia, Pa.

June 4-6—AMERICAN ASSOCIATION OF ENGINEERS. 8th Annual Convention. Salt Lake City, Utah.

THE NEW ENGLAND WATER WORKS ASSOCIATION

The February meeting of this association will be held at the Boston City City, February 14th, 1922.

Program: 11.00 a. m., meeting of executive committee at the headquarters, Tremont Temple; 1.00 p. m. luncheon at the Boston City Club.

2.00 p. m., paper: "The Proposed Extension of the Metropolitan Water Supply," by X. H. Goodnough, chief engineer, Massachusetts Department of Public Health, Boston, Mass., illustrated; will discuss the resources of the present metropolitan system, the necessity of immediate extension, and will describe the additional works proposed. Time permitting, discussion will be had on one of the following practical subjects: "Carrying Cast Iron Pipes Through Foundation Walls"; "Use of Extension Stems Over All Street Gates"; "Operation of Distribution System with Valves Partially Closed."

AMERICAN SOCIETY OF CIVIL ENGINEERS

At the regular business meeting, February 1, Col. John P. Hogan presented a paper on the "Past and Predicted Growth of Power Demand in New York State." It covered the salient points in the development of the most important essential to any extensive power project—a market—as it relates to the greatest urban development in the country and was illustrated by lantern slides.

NEW YORK SECTION, A. S. C. E.

The subject of the meeting of this section held in New York on December 21st, was zoning, and what it has done for New York. The matter was discussed by Edward M. Basset, John B. Fox, Rudolph P. Miller, Clarence S. Stein and others, and the points brought out were the protection of residence and retail districts, the curbing of skyscrapers, and the need of decentralization of the city's industries.

THE NATIONAL CIVIC FEDERATION

The twenty-second annual meeting was opened in New York, January 29, former Judge Alton B. Parker presiding. The federation is composed of leading employers, labor union officials and a group representing the public.

Among the principal subjects discussed were the right of railroad and other public utility workers to strike, the advisability of establishing tribunals possessing the power to compel arbitration and submission to the consequent awards, and the use of injunctions in capital and labor disputes.

Former Governor Ben W. Hooper, vice-chairman of the United States Railroad Labor Board, advocated extension of the board's powers to compel obedience to its decisions; Glenn E. Plumb, representing the Railroad Employees' Department of the American Federation of Labor, wanted the board abolished. Samuel Gompers joined in attacking the Hooper contentions and contended that compulsory arbitration means compulsory labor.

Matthew Woll, international president of the Photo Engravers' Union, declared that the courts, including the Supreme Court of the United States, violated the constitutional rights of the workers in some of their decisions, especially in the matter of injunctions. Judge Parker asserted that the Federal courts had not seized any judicial powers which the Constitution did not intend them to have.

Governor Hooper denounced strikes as a means of settling railway labor controversies, terming them "economic war."

Mr. Plumb attacked all industrial court theories based on the Allen law of Kansas.

Mr. Gompers denounced court and other efforts which, he said, were being made to bring about compulsory labor.

BROOKLYN ENGINEERS' CLUB

At the meeting of January 26, a paper on The Plans of the Port of New York Authority, illustrated by lantern slides, was presented by B. F. Cresson, Jr., chief engineer of the Port of New York Authority.

At the meeting of this club on Thursday evening, February 2nd, "Recent Developments in Concrete," illustrated by lantern slides, was given by Col. H. C. Boyden, engineer for the Portland Cement Association, and important discoveries as to "Water Content" and "Setting" were discussed.

ENGINEERS' ASSOCIATION OF FAIRFIELD COUNTY

The regular meeting, at Stamford, February 2, was addressed by Frank W. Skinner, associate editor, PUBLIC WORKS, on "Tunnelling," illustrated by numerous stereopticon slides.

Among the important tunnels described were the Simplon line, the underground tubes in London and Paris, and various types of tunnels in New York, where the operations of driving through quicksand, boulders, and partly through rock and silt, involve unusual difficulties that have been met with great skill and ingenuity as in the case of short steel tube tunnels towed a long distance and sunk to bearing on pile foundations; a Harlem River tunnel built in an airtight lined dredged trench, covered by a massive timber platform; the quadruple track steel lined tunnel with its tubes built on shore, launched, floated to position, sunk under pneumatic control in successive sections and eventually enclosed in a monolithic mass of concrete deposited under water by multiple tubes, and the shield driven Pennsylvania Railroad, Rapid Transit tunnels and Hudson Tubes.

Some of the notable tunnel accidents,

due to flooding, poisonous gas and fire were described, together with the means for preventing them, and a resume was given of various ingenious methods devised for tunnel construction under the most difficult conditions, including the centre or pilot tube for a Brooklyn sewer tunnel, and the sectional roof lining, both for quicksand operations, the freezing process and the caisson process for subaqeous tunnels, the improved trench methods advocated for the Narrows tunnel and the North River tunnels, New York, the half shield, the caisson and the floating anchored type with examples of different constructions involving brick, concrete, steel, wood. cast iron and concrete linings.

The address was one of a series that includes long and lofty bridges; municipal waterworks, highways and pavements, and other important types of necessary construction work that are emphasized because of the high returns that they yield directly, and the development, prosperity and quick relief that their construction affords both for unemployment and for the present prolonged stagnation of business and construction. These features make the design and construction of such public works a great public benefit and afford engineers, contractors and officials an opportunity for performing services of the highest value to the commonwealth that at the same time compensate and distinguish their authors.

ANNUAL MEETING OF NEW JERSEY MUNICIPAL LEAGUE

The annual meeting of the New Jersey League of Municipalities met at Trenton on January 30 and discussed the State's blue laws, and the exemption of new dwellings from taxation. The session was addressed by Dr. Copeland, health commissioner of New York City, who spoke of the pollution of New Jersey beaches, which address resulted in the adoption of resolutions protesting to the Federal authorities against the pollution contributed by the dumping of garbage by New York City and the discharge of oil wastes, sewage and factory refuse along the seacoast.

Commissioner Gillen stated that the problems in connection with public utility legislation were becoming so serious that their possible ultimate solution can be found only in public ownership.

The league elected the following offers: President, Commissoner Charles P. Gillen, of Newark; Vice Presidents, Mayor Clarence E. F. Hetrick, of Asbury Park; Commissioner James F. Gannon, of Jersey City, and Mayor Edward L. Bader, of Atlantic City; with Clinton J. Swartz, of Trenton, as secretary-treasurer.

On January 28th Major Charles H. Miller of Little Rock, at one time a director of the A. S. C. E., was elected president of the Arkansas chapter of the A. A. E.; and Major E. A. Kingsley was re-elected secretary.

KANSAS ENGINEERING SOCIETY

The fourteenth Annual Meeting of the Kansas Engineering Society was held at Hutchinson, Kansas, on December 22nd and 23rd, 1921. This meeting was one of the most interesting, as well as the most beneficial meetings the organization has ever held. Considerable progress was made during the past year and the Society went on record at this meeting as being in favor of all progressive legislation questions that may arise.

Particular interest is felt in the legislation for the patent office as prescribed in the Lampert Bill, H. R. 7077, which seeks to effectively remedy the existing condition of the Patent Office at Washington. It is hoped that other organizations interested in matters pertaining to the proper development of this Department will take such action as is necessary to bring it properly before their Senators and Representatives, that favorable action may be had by Congress.

The newly elected officers are: Lloyd B. Smith, president; P. L. Brockway, vice president; J. M. Averill, secretary-treasurer; P. J. Ruckel and H. B. Walker, directors.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

At the annual meeting of the American Society of Agricultural Engineers held in Chicago December 27th-29th, the following subjects were discussed: flood control, drainage and irrigation in relation to agriculture, and farm buildings, their construction, sanitation and drainage. Prominent among the papers was one on "Flood Control in Agriculture," by Arthur E. Morgan. The following officers were elected for 1922: president, A. J. R. Curtis; vice-presidents, G. W. McCuen and David Weeks; and secretary, Raymond Olney.

ENGINEERING INSTITUTE OF CANADA

At the annual meeting of the Engineering Institute of Canada held at the Montreal headquarters of the society on January 24-25 three new chapters of the society were established, technical discussions were presented, and officers for the coming year elected. These are: President, J. G. Sullivan, and vice-presidents, Brig. Gen. C. B. Mitchell and Arthur Surveyor. The three new branches of the society are at Sydney, Nova Scotia, London, Ont., and Lethbridge, Alberta. The social features of the meeting included a visit to the Dominion Engineering Works at Rockfield, the annual banquet and a smoking concert.

DETROIT ENGINEERING SOCIETY

The feature of the February 3rd meeting of the Detroit Engineering Society was an illustrated address by Clifford M. Holland, chief engineer of the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission, on "The Hudson River Vehicular Tunnel Its Construction and Ventilation."

The Engineers' Society of Western Pennsylvania has moved from 568 Union Arcade Bldg. to the William Penn Hotel, Pittsburgh.

PERSONALS

Fauntleroy, Capt. J. D., for the past five years federal district highway engineer in Texas of the Bureau of Public Roads, was appointed state highway engineer at a salary of $9,000, to fill the vacancy caused by the recent resignation of Rollin J. Windrow.

Hubbell, Clarence W., city engineer of Detroit, Mich., has tendered his resignation to Joseph A. Martin, commissioner of public works, to become effective March 1.

Miller, Frank, has been appointed commissioner of water for Toledo, O., to take the place of George N. Schoonmaker, who has been at the head of the water department since September 20, 1920.

Piper, Oscar A., who has been connected with the Seattle city engineer's department since 1908, has been appointed superintendent of streets and sewers for that city.

Kluegel, Harry A., until recently construction engineer in the Quartermaster Corps, U. S. A., has been named chief of the division of water rights for the State of California.

Costello, James, has been appointed division superintendent in the county road department, Allegheny County, Pa.

Husted, A. G., has become assistant sanitary engineer of the sanitary engineering district of Cuyahoga County, Ohio.

Goodrich, Clinton R., has been made commissioner of public works of Utica, N. Y.

Hanson, Conrad, has been appointed highway commissioner for Douglas County, Wisc.

Doucet, A. E., director of public works, Montreal, Quebec, has resigned, effective Feb. 1.

McDougald, W. L., of Montreal, has been appointed chairman of the harbor commission of Montreal.

Coyne, Thomas, has been reappointed superintendent of streets of Marlboro, Mass.

Thomas, O. P., of Johnstown, Pa., has been elected borough engineer of Conemaugh, Pa.

Colony, J. I., has been elected borough engineer of Renovo, Pa.

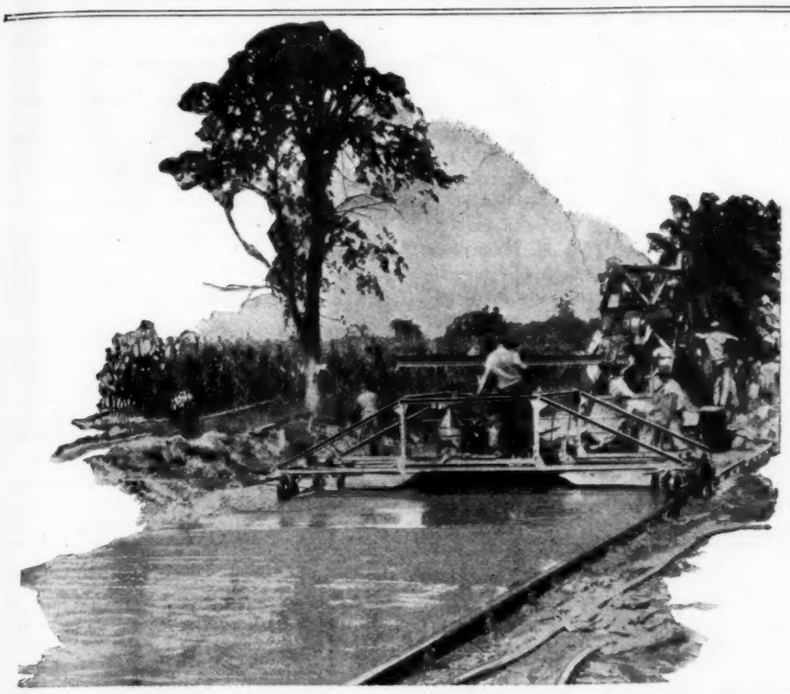
LEWIS S. SADLER

Lewis S. Sadler, Pennsylvania State Commissioner, died at his home in Carlisle, Pa., January 20. He was forty-eight years old, and had been ill a week.

Mr. Sadler was prominently mentioned in the recent discussion of candidates to succeed the late Senator Boies Penrose, and for nomination next fall to succeed Governor Sproul.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



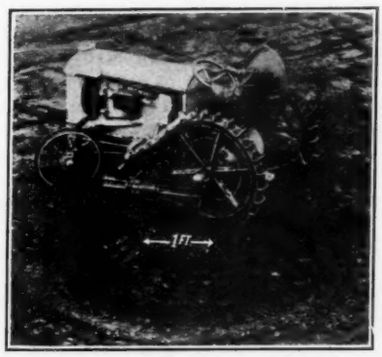
MAXON CONCRETE ROAD FINISHER

This machine, built by the Maxon Company, is provided with a 9-horse power gasoline engine and has two demountable rear wheels to transfer it from place to place. It has no cast iron, all castings are the finest grade of semi-steel, malleable iron or cast steel and all gears are cut. Among the valuable features reported are the divided strike-offs that insure perfectly balanced motion and minimum reaction on the forms; a pneumatic tamper with adjustable scoop and crusher; slow moving, long stroke adjustable belt float; completely enclosed transmissions; all metal, durable strike-off and tamper; independence of the different operations; absence of vibration; and central position of operator. The tamper extends across the full width of the road and is operated by compressed air.

BATES' CRAWLER DRIVE FOR FORDSON TRACTOR

The latest development of the Bates' Machine & Tractor Co. is a steel crawler drive for the Fordson Tractor. It is the same general construction as the crawlers on the Bates Steel Mule. It can be put on in the field in about an hour's time as it is not necessary to drill a single hole or alter the tractor in any way. The drawbar pull of the Fordson is greatly increased on soft ground or sandy soil due to the grip of the crawler traction. Dynamometer tests show an increase in drawbar horse-power on soft ground ranging from 25 to 60 per cent.

The sprockets are of alloy steel with openings between the teeth which permit the dirt to fall through, and is a patented construction of the Bates' Steel Mule.



TURNING IN MINIMUM CIRCUMFERENCE

These sprockets are mounted directly on the rear axle shaft. The front idler crawler wheels are the same as the Bates' Steel Mule and are carried on Hyatt Roller Bearings, entirely inclosed from the dust. The tension of the crawlers is taken up by coil springs which are adjustable. To get the same pressure on the front end of the crawlers as on the rear, a semi elliptical spring is attached to the front of the crawler frames and the under part of the tractor. This spring is pivoted in the center which permits the crawlers to oscillate entirely independently of each other and at the same time get an equal pressure at all points.

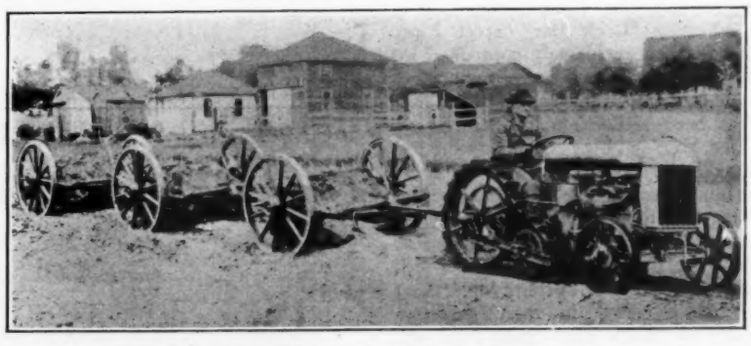
The tractor is fitted with two crawler turning devices, each having an independent foot lever so that either crawler can be slowed down or stopped entirely for short turning, with the result that an inside turning circle of 2 feet is obtained. The 8-inch wide crawler shoes are so made that rubber blocks can be attached on to the crawler at a slight additional cost for hauling over pavements or any highway that might otherwise be injured by metal cleats. These rubber clad crawler's shoes are also used for hauling in and around industrial plants. The manufacturers have announced the price of $295.00.

AUSTIN DRUM MIXERS AND PAVERS

The Austin Machinery Corporation have just placed on the market a complete line of popular-priced drum mixers.

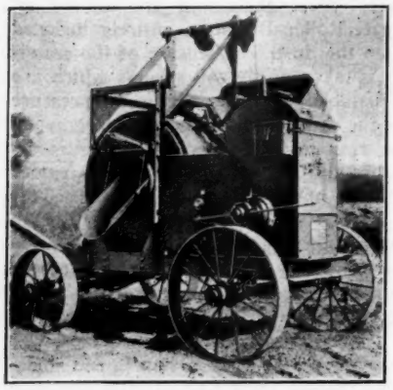
Heretofore the Austin mixers have been of the cube design the mixing being acomplished without the aid of blades or paddles, simply by throwing the batch from plane to plane with a force varying according to the speed of revolution. This necessitated materials and construction of unusual strength, which naturally would reflect in the price asked.

In the new drum type mixer, recourse



BATES CRAWLER HAULING THREE WHEEL SCRAPERS ON ROAD GRADING JOB

is had to the customary elevating mechanism of the interior. The consequent freedom from unusual strain saves on construction cost and meets the demand for a moderately-priced mixer, equal to every ordinary requisite in the way of volume, rate and quality of output, working life, low maintenance cost, and manageability.



AUSTIN PORTABLE CONCRETE MIXER

The same principle has been utilized to produce a secondary line of Austin pavers. The mixers will be supplied in all standard sizes from one-half bag to two yards, and the Pavers in sizes from one-half yard to two yards.

INDUSTRIAL NOTES

Bucyrus Co., South Milwaukee, Wis., with Northwestern sales office at 608 Pittock Block, Portland, Ore., announces the appointment of A. R. Hance as Northwestern sales manager, succeeding L. T. Russell, who has resigned after ten years of service with the company.

The Triest Contracting Corporation, W. G. Triest, president, 126 E. 59th Street, New York City. The corporate name of Associated Contractors, Incorporated, has been changed to Triest Contracting Corporation. Mr. O. A. Mechlin, formerly Commander C. E. C., U. S. Navy, R. F., has joined as vice-president.

An agreement has recently been reached between the East Jersey Pipe Company and the Riter-Conley Company whereby "Lock Bar" Steel Pipe, which has been exclusively controlled by the East Jersey Pipe Company since its introduction into this country in 1905 and has been hitherto manufactured by the East Jersey Pipe Company at its plant at Paterson, N. J., will be hereafter fabricated in the Pittsburgh district by the Riter-Conley Company at its Leetsdale plant. This is regarded as a step forward by both parties, as it will permit considerable saving in freight rates and economy in manufacturing. The sale of "Lock Bar" Steel Pipe will continue to be exclusively in the hands of the East Jersey Pipe Company.

The Dayton-Dowd Co., Quincy, Ill., announces the opening of a district office in Pittsburgh at 809 Keenan Building, covering the sale of their Centrifugal Pumps and Underwriters' Fire Pumps. The office will be in charge of Mr. T. J. Barry, who for the past several years has been connected with the home office on engineering and sales.

At the Chicago Good Roads Show the Pawling & Harnischfeger Company distributed a novel souvenir which consisted of two concentric cardboard discs, pivoted together by an eyelet in the center. The idea back of this novelty was to show why the P. & H. Excavator Crane was an eight-in-one machine. By revolving the upper disc the various booms that may be used with P. & H. appear successively—the standard boom with dragline bucket, boom with garb bucket, boom with material handling hook, boom with Magnet, boom with backfilling scraper, shovel attachment, skimmer scoop and pile driving rig.

The City of Indianapolis has just ordered a sample garbage cooker like those that are now in use in Dayton, Ohio, and which are claimed to be odorless. If the new cooker proves satisfactory it is expected that Indianapolis will purchase 11 more.

COST OF TRACTOR SERVICE FOR ROAD GRADING

Tractors manufactured by Case Threshing Machine Co. were satisfactorily used on road grading contracts by W. A. Kettlewell, Iowa City, Iowa, who writes that in very light sand the tractor loaded a Maney wheeler with a 75 foot snap cable. It was necessary to carry the 11,000-yard cut to grade as the work progressed and the wheeler was pulled up out of a sand pit about 12 feet in depth.

The tractors "both proved themselves to be very satisfactory on our work. The machines both stood up exceptionally well and your service has been all that we could ask. While the machines always had the best possible care, both were put through the hardest kind of tractor service. At the end of the season only a few minor repairs were required to have them back in strictly first class condition. * * * The 22-40 H.P. tractor has ample power to deliver the goods in anything we encountered and is still light enough to handle easily in very difficult places."

Operating Costs—Case 15-27 Tractor

Basis — Case 15-27 H. P. Tractor in use on highway grading for loading Maney Four-Wheeled Scrapers of one cubic yard capacity during the year of 1919.

76 2-3 nine-hour working days.

122 calendar days.

Yardage moved approximately, 29,000 cubic yards.

Item	Cost per Working Day
Labor Operating	$6.85
Repairs	2.14
Accessories, small tools, etc.	.29
Fuel and oil	3.89
Depreciation, annual	6.52
Interest	1.00
Total cost per working day	$20.69

The tractor was in perfect condition at the end of this period.

Operating Costs—Case 22-40 Tractor

Basis — 1 Case 22-40 H. P. Tractor working on highway grading to load Maney Four-Wheeled Scrapers of one cubic yard capacity.

125.5 nine-hour working days between April 10 and October 10, 1920.

Yardage moved approximately, 41,000 cubic yards, which material included a large percentage of fine sand or heavy mud.

Item	Gallons Used per Working Day	Cost per Working Day
Labor operating	....	7.771
Repairs	....	1.29
Cylinder oil	2.87	1.833
Kerosene	24.3	4.877
Hard oil	30 lbs	.041
Gasoline	7.18	2.00
Transmission oil	.661	.483
Interest, annual	....	1.50
Depreciation, annual	....	7.00
Storage, annual	....	....
Taxes & Insur.	....	....
Total	....	$26.80

Average prices of fuel and supplies as follows:

Kerosene	$0.20	per gal.
Gasoline	.276	per gal.
Hard oil	.17	per lb.
Cylinder oil	.64	per gal.
Transmission oil	.73	per gal.
Labor operator	139.33	per month

The item of repairs includes daily field repairs and general shop repairs.

TRACTORS HAULING ROAD MACHINES IN HEAVY WORK